CENTRAL INTELLIGENCE AGENCY
# INFORMATION REPORT



50X1-HUM

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| COUNTRY | East Germany | REPORT | [redacted] |
| SUBJECT | VEB Funkwerk Koepenick: Research on Directive and Effective Antenna Gains | DATE DISTR. | 4 April 1955 |
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THE SOURCE EVALUATIONS IN THIS REPORT ARE DEFINITIVE.
THE APPRAISAL OF CONTENT IS TENTATIVE.

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1. During 1954, Department TEA (Technical Development of Antennae) of VEB Funkwerk Koepenick (headed by [redacted] Eng. Horst Geschwinde) carried out research concerning antenna gain in the UKW range. This research was under the supervision of Eng. Rolf Gruss [redacted] It was carried out as a preparation for similar studies in the centimeter wave range. The studies included theoretical work as well as experimental investigations. 50X1-HUM

2. Directive gain

   a. Theoretical basis: the following expression can be used in a cartesian coordinate system for the directive gain:

$$D = \frac{4\pi}{\iint f(\theta,\varphi)\,d\theta\,d\varphi}$$

   If the symmetry axis of the loop in figure 1 of the annex is selected as Z-axis it follows that

$$D = \frac{4\pi}{\int_0^{2\pi}\int_0^{2\pi} f(\theta)\,d\theta\,d\varphi} = \frac{2}{\int f(\theta)\,d\theta}$$

   $f(\theta)$ was determined by use of two methods:

   1) Theoretically according to Maxwell.

   2) Experimentally. This was followed by numerical integration.

   b. Investigations of V-antennae and of Yagi antennae had the following results:

   1) Directive gain of V-antennae: about 10 decibels.

   2) Directive gain of Yagi antennae: about 14 decibels.

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indicated by "X"; Field distribution by "#".)

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These results were obtained through use of concentric line resonators (Topfkreise). In order to obtain more accurate measurement results for the side loops of the diagram, development of a special measurement device for field intensity was started. The device was to have the following specifications: frequency range, 30 to 300 mcs; sensitivity, about 100 micro-volt; unsymmetrical input with characteristic impedance (wave resistance), Z=60 Ohm. As of January 1955, construction of the device had not yet begun.

3. Effective gain

In addition to the radiation characteristics, this gain is dependent upon the Ohm losses (heed losses, Joule losses) and upon the mismatching.

a. Theoretical basis: the effective gain G equals alpha • D where alpha represents the efficiency factor expressing the Ohm losses and the mismatching. In case of matching, alpha becomes equal to K where K is the absorption factor. Thus G = k • D. If G and D are known the losses can be determined. Determination of D is described above.

b. Measurement of G: the following two methods were planned:

1) The comparison method (see annexed figure 2). According to this method G is determined by the following formula

$$G = \left(\frac{V_2}{V_1}\right)^2$$

where $V_1$ is the voltage of the unknown antenna and $V_2$ is the voltage of the known antenna.

2) The absorption method (see annexed figure 3). G is obtained with the aid of the approximation formula by Friis.

$$G = \sqrt{\frac{P_E \cdot P_R}{r^2}}$$



where $P_E$ is the emission power, $P_R$ is the receiving power and r is the distance of the two antennae. [redacted] used if the two antennae $S_A$ and $E_A$ (see [redacted] identical. The studies concerning dete[redacted] interrupted [redacted] continued in 1955.

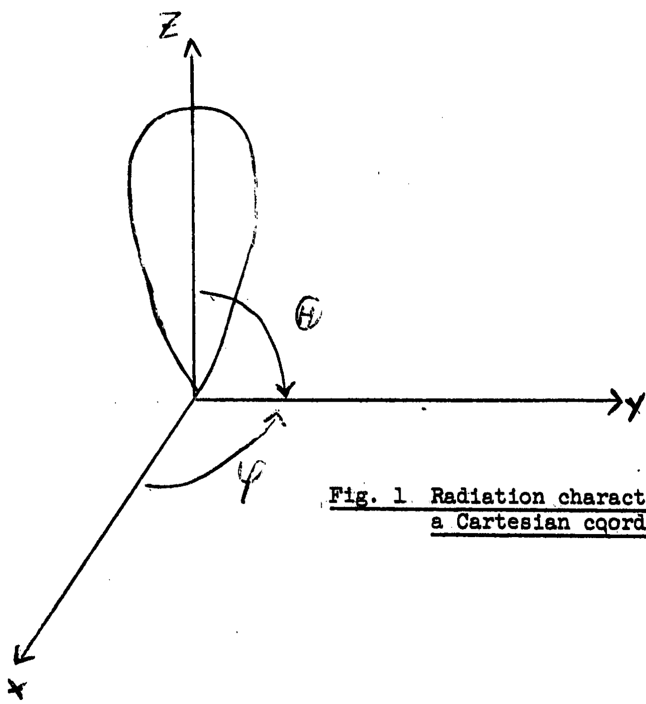


Fig. 1 Radiation characteristics in a Cartesian coordinate system

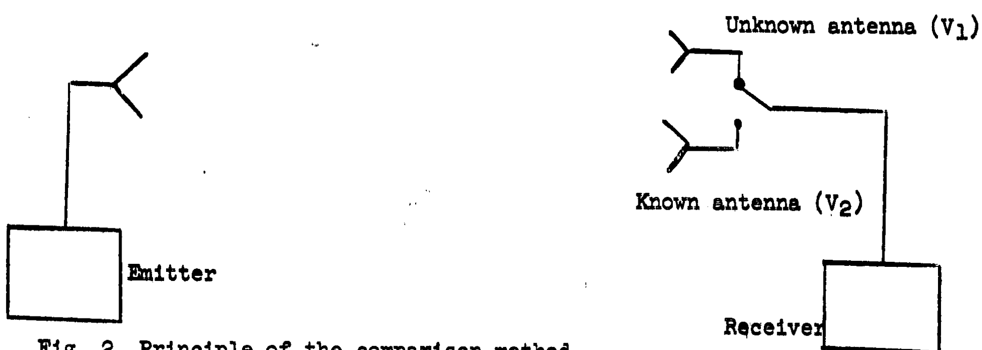


Fig. 2 Principle of the comparison method

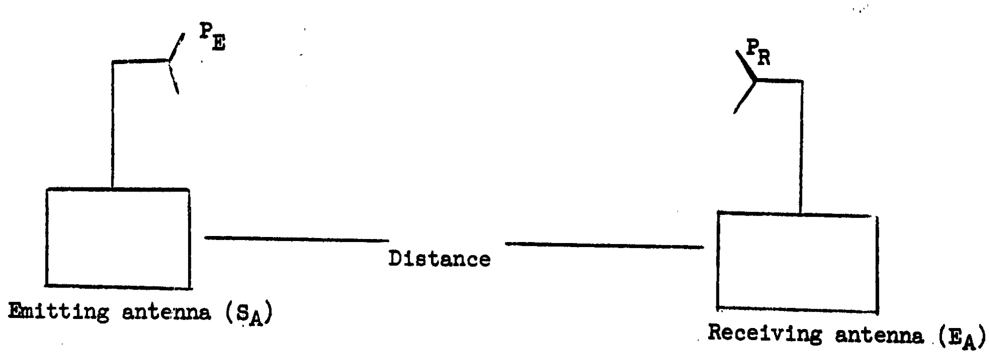


Fig. 3 Principle of the absolute method